~~A~~ COMBINATION SMOKE ALARM AND WIRELESS LOCATION DEVICE

~~FEDERALLY SPONSORED RESEARCH Not Applicable~~

~~SEQUENCE LISTING OR PROGRAM Not Applicable~~

CROSS REFERENCE TO RELATED APPLICATIONS

This application ~~is entitled to the~~ claims the benefit of Provisional Patent Application Ser. No. 60/416,970, filed October 8, 2002, and Provisional Patent Application Ser. No. 60/416,971, filed October 8, 2002 where these two provisional applications are incorporated herein by reference in their entireties.

BACKGROUND OF THE INVENTION

~~1.~~ Field of the Invention

~~(0001) The present invention~~This disclosure relates generally to smoke alarms and wireless telecommunications systems. More specifically, ~~the present invention~~this disclosure provides a combination device and method for locating a smoke alarm utilizing wireless E-911 ~~wireless~~ telecommunication location systems.

~~2.~~ Description of ~~Prior~~Related Art

~~a. Prior Art~~ Smoke Alarm Devices and Systems

~~(0002)~~ Smoke alarm devices and systems are valuable fire protection tools that save life and property. Detecting smoke at the earliest stages of a fire, alerting building occupants for rapid, evacuation, and notifying emergency response resources of the fire are key factors for any general fire safety plan. However, failure of any one of the key factors ~~dramatically~~ increases the fire danger. ~~In sum, in building~~ Preparing for fire scenarios, ~~reduced~~ reducing physical

injury, ~~reduced~~ reducing loss of life, and ~~reduced~~ reducing property ~~damaged~~ damage are all dependent upon building occupants safely evacuating a burning building~~,~~ and quickly contacting emergency response personnel ~~to help render aid and extinguish the fire~~.

~~(0003) Many configurations~~ One type of smoke alarm ~~devices and systems exist in the prior art. Self-contained,~~ device is a self-contained, independent smoke alarm ~~units provide either~~ unit with photoelectric, ~~or~~ ionization, ~~sensors~~ or both types of sensors to ~~rapidly~~ detect smoke, provide an AC and/or DC power ~~sources~~ source, and provide an audible alarm horn and/or visual alarm ~~strobe light~~ signal to alert building occupants of a potential fire. For example, ~~the First Alert~~ a FIRST ALERT® SA302 smoke alarm provides both photoelectric and ionization sensors in one unit. ~~In addition, the Gentex~~ A GENTEX® DL2220 smoke alarm features an ADA-compliant 90 dB audible alarm horn and 177 candela strobe light for hearing impaired persons.

~~(0004) Although~~ One drawback of such self-contained units ~~provide many innovative features, many drawbacks exist~~ is that these units do not communicate with each other. For instance, in larger buildings containing many rooms or multiple levels, even when equipped with multiple self-contained smoke alarm units, ~~a~~ the self-contained smoke alarm may detect smoke and fire in remote or unoccupied areas for unknown periods of time before the occupants are alerted to the fire, ~~allowing~~ which allows the fire to spread. Furthermore, physically-challenged, intoxicated, or sleeping occupants may not hear or otherwise respond to the ~~activated smoke~~ audible or visual alarm of the self-contained unit located in a remote part of the building before being overcome by smoke inhalation. These drawbacks substantially increase the fire danger to occupants, property, and emergency response personnel. Thus, self-contained smoke alarms have serious limitations relating to alerting building occupants, who are in turn responsible for contacting emergency response personnel.

~~(0005) Recognizing the above and other shortcomings of self-contained smoke alarms,~~ In response to the above, some federal, state, ~~and~~ and/or local fire ~~code~~ codes may require that ~~newer~~ new residences ~~install~~ incorporate multiple, self-contained smoke alarms equipped with hard-wired interconnection terminals ~~for~~ forming a network and thus permitting the activation of multiple smoke ~~alarm activation~~ alarms. The interconnection terminals allow multiple smoke alarms to be interconnected within a building, so when any one of the interconnected smoke alarm senses smoke, other interconnected alarm are activated. ~~For~~ One example~~, Tanguay and Kondziolka (~~ of a networked smoke alarm system is described in U.S. Pat. No 6,362,743~~) provides a smoke alarm with an interconnection terminal~~. ~~Additionally, the First Alert~~ The FIRST ALERT® SA4121 smoke alarm also provides interconnection terminals.

~~(0006) Smoke alarms providing~~ Another type of smoke alarm system utilizes wireless interconnections ~~operate on a principle similar to hard-wired interconnected~~ to permit communication between the smoke alarms. However, ~~wireless smoke alarms do often employ~~ this system requires short-range transceivers ~~for achieving interconnection with~~ to transmit the wireless signal to/from other smoke alarms. ~~For instance, Morris (U.S. Pat. No. 5,587,805)~~ One wireless smoke alarm system that provides a multiple alert smoke alarm in which two or more smoke alarms containing wireless FM transmitters provide multiple alarm activation is described in U.S. Pat. No. 5,587,805. ~~Additionally, Curl (~~ A similar system is described in U.S. Pat. No. 5,019,805~~) provides~~, which describes a smoke alarm featuring ~~both~~ an interconnection via an AC power line carrier signal and interconnection via wireless ~~signal means~~ signals.

~~(0007) Despite solving some of the problems of self-contained smoke alarms, drawbacks exist with the above-mentioned interconnected smoke alarms. For example, although~~ Although interconnected smoke alarms may alert building occupants to fires in remote or unoccupied areas, if the building is

unoccupied or vacant, the fire will go undetected, which may allow the fire to spread ~~until the fire spreads to out of control~~. ~~Only in the event neighbors~~ Neighbors or other observers ~~haphazardly~~ would have to notice the burning building ~~will~~ and contact the emergency response personnel ~~be contacted~~. ~~This scenario may cause the fire to spread to adjacent property, or, in rural settings, cause a wildfire, increasing the danger to public safety, property, and emergency response personnel.~~

~~(0008)~~ Other types of hard-wired or wireless interconnected smoke ~~alarms are part of~~ alarm systems are typically integrated with residential or commercial building security systems, which are primarily designed for intrusion detection and home automation. For example, ~~the~~ a smoke alarm system called the ~~NAPCO Gemini~~ NAPCO® GEMINI® system provides a modular residential security system~~, consisting of~~ comprising a separate wall-mounted control panel, a keypad, a wireless receiver, ~~and~~ various wireless security sensors, ~~including~~ and a wireless smoke ~~alarms~~ alarm. ~~These systems~~ The GEMINI® system may ~~contain~~ also include a telephone auto-dialer connected to a ~~"wireline"~~"wireless" telephone, which ~~then~~ is configured to automatically ~~notifies~~ notify a commercial security monitoring service ~~center~~ upon activation.

~~(0009) The shortcomings of integrated~~ Integrated security systems ~~containing~~ that include smoke alarms ~~are numerous. First, such systems are~~ can be cost prohibitive ~~for fire protection, due to the numerous non-essential components and sizable installation costs~~ if the primary goal of the building owner is to monitor for fire. Also, integrated security systems require skilled technicians to install, test, and maintain the entire system. ~~Second, in~~ In addition to the system complexity, installation, and ~~sizable up-front~~ maintenance costs, the integrated security ~~systems~~ system may not include a smoke ~~alarms with~~ alarm in the basic ~~security~~ system ~~package~~ configuration. ~~Furthermore,~~ Further, the integrated security ~~systems~~ system often ~~require~~ requires an additional telephone

line, ~~and utilize~~ requires an off site commercial security monitoring ~~services, requiring additional~~ service, and requires the payment of monthly service fees.

~~(0010) A further limitation of all of the above-mentioned~~ Another drawback of the aforementioned smoke alarm devices and systems~~,~~ is that they are not designed for installation in ~~building structures undergoing~~ buildings that are under construction or otherwise unoccupied~~, or an effective means for fire monitoring in vacant residences or commercial buildings~~. ~~In most residential and commercial buildings under construction, there is no means for fire monitoring,; and registered street address. The workers on the~~ Workers at a construction site ~~and~~ and/or persons in the immediate vicinity are the primary means for ~~monitoring~~ noticing a potential ~~fires~~ fire. Because ~~such~~ unoccupied buildings ~~may be~~ are typically vacant during ~~the off work~~ off-work hours, a ~~potential~~ fire may ~~burn unnoticed before it rages out of control, causing~~ cause increased ~~fire~~ damage to the ~~said~~ building, increased damage to adjacent properties, ~~and~~ and/or pose an increased danger to emergency response personnel.

~~(0011)~~ Another ~~key~~ drawback of ~~existing~~ some self-contained and interconnected smoke alarms is the lack of effective means for automatically notifying emergency response ~~resources~~ personnel of the specific location of the fire emergency. ~~Having direct~~ Direct contact with a public 911 dispatch center, often referred to as a Public Safety Answering Point ("PSAP"), ~~is one of the key factors in overall fire safety~~ can be a factor in the response time of the emergency response personnel.

~~(0012)~~ For example, during a fire emergency, evacuating building occupants are faced with sudden conflicting decisions, which include immediately evacuating the burning building, helping others to evacuate safely, gathering valuable property, or calling 911 to report the fire and summon emergency response resources.

~~(0013)~~ In most cases, building occupants calling 911 in a fire emergency will use a conventional ~~wireline~~wireless telephone or a mobile cellular telephone to call 911. ~~But oftentimes these telephones are located inside of the burning building that the occupant is attempting to evacuate. The main drawback is that an occupant who is attempting to use a telephone will be~~ In such a situation, the caller may be in a heightened state of anxiety and confusion, so ~~spending time~~ locating a telephone, dialing the number, waiting for a call connection, and ~~verbally~~ articulating the nature of the emergency ~~and other detailed information~~ to a 911 dispatcher can waste critical evacuation time. These complexities place children, the elderly, and the handicapped at high risk.

~~(0014)~~ Therefore, a need exists to provide a smoke alarm that automatically notifies ~~PSAP's and emergency response resources,~~ a 911 dispatch center and automatically ~~determines the~~ provides a geographic location of the emergency ~~smoke detection alarm. A smoke alarm combined with these novel features will exponentially increase fire safety for people and property~~.

~~b. Prior art~~ Wireless Telecommunication Systems, mobile cellular telephones, and emergency 911 systems.

~~(0015)~~ The existence of wireless telecommunications network systems, often referred to as cellular networks, along with mobile cellular telephones, are well known ~~in the prior art~~. ~~Aside from being a revolutionary innovation for mobile voice and data communications, many other uses exist, such as determining the geographic location of a mobile cellular telephone. Wireless location is important for a wide range of applications including telematics, mapping and direction finding, and emergency services.~~

~~(0016)~~ Due to a dramatic increase in 911 calls originating from mobile cellular telephones, ~~wireline~~wireless E-911 needed to be modified to provide a callback number, fixed address and/or geographic location information of

mobile cellular telephone. Although the majority of ~~wireline~~wireless telephones in the United States have wireless E-911 capabilities, mobile cellular telephones do not.

~~(0017)~~ Recognizing the ~~importance of wireless location for public safety, in 1997~~ proliferation of cellular phones, the Federal Communications Commission ("FCC") enacted ~~regulatory mandates~~ a regulation requiring wireless telecommunications carriers to upgrade and modify their wireless network infrastructure ~~and associated PSAP equipment, and make appropriate upgrades to mobile cellular telephones~~ and cellular phone capabilities. ~~These combined efforts would create~~ The resulting system is known as a wireless telecommunications location ~~systems~~ system ("WTLS"), which ~~comprises a wireless telecommunications infrastructure, a PSAP, and mobile cellular telephones. The WTLS~~ allows ~~PSAP's and~~ an emergency response ~~authorities~~ authority to automatically determine the geographic location of a mobile cellular telephone, ~~or track its~~ and possibly even track the movements of the cellular phone during an emergency ~~calls to 911~~ call. ~~(0018)~~ Accordingly, a new wireless location concept, called wireless~~,~~ Enhanced 911 ("wireless E-911") service is being deployed nationwide. ~~Aside from the wireless network upgrades cited below, a PSAP is~~ In addition, dispatch centers may be equipped with a modified Geographic Information System ("GIS") that displays city or county maps and other information, to automatically pinpoint the geographic location of the wireless 911 caller. The ~~PSAP~~ emergency personnel may then ~~dispatch appropriate emergency response personnel~~ be dispatched to the location of the ~~wireless 911 caller~~ cellular phone. Wireless E-911 is designed to save lives by reducing the response time and increasing the accuracy of emergency response resources responding to emergency calls. ~~A~~ One system that uses wireless E-911 capabilities is described ~~wireless location system is disclosed~~ in ~~Kovach, Jr., et al.~~ ~~(~~U.S. Pat. No. 6,317,604~~)~~.

~~(0019)~~ Numerous wireless E-911 location concepts exist in the prior art to achieve WTLS capabilities. The numerous concepts include measuring the time difference of arrival and angle of arrival of signals transmitted from mobile cellular telephones to base station ~~("BS")~~ antennas. These concepts generally require a plurality of ~~BS~~ base station antennas to "triangulate" the signal transmission to determine the geographic location. These concepts operate best when there is a high concentration of ~~BS~~ base station antenna sites. Otherwise, increasing wireless transceiver amplifier output, or other supplemental means may be needed. ~~A wireless location concept similar to this is disclosed by Stilp (~~One type of a base station antenna system is described in U.S. Pat. No. 6,184,829~~)~~. These wireless location concepts ~~are~~ may be governed by the FCC wireless E-911 Phase II network-based regulatory mandate requiring a WTLS to locate ~~an~~a wireless E-911 caller within 100 meters for 67% of calls, and/or within 300 meters for 95% of the calls.

~~(0020) Another concept existing in the prior art integrates~~ One approach to identifying the location of a cellular phone is by integrating a Global Positioning System ("GPS") receiver into ~~a mobile~~ the cellular phone ~~telephone, which provides an alternate means for location determination~~. GPS is a popular satellite-based navigation system that provides coded satellite signals that are processed in a GPS receiver to yield the position and velocity of the ~~receiving unit~~ receiver. This location ~~concept~~ method generally requires ~~the~~ a line-of-sight signal transmission of a plurality of GPS satellites to determine the ~~location~~ coordinates of the GPS receiver. ~~A wireless location concept incorporating GPS and WTLS is disclosed by Soliman (~~A cellular phone that incorporates a GPS receiver is described in U.S. Pat. No. 6,353,412~~)~~. ~~This location concept is governed by the FCC's E-911 Phase II handset-based regulatory mandate requiring~~ According to an FCC regulation, a cellular phone with an integrated GPS receiver must provide

a location accuracy within 50 meters for 67% of the calls, and/or within 150 meters for 95% of the calls.

~~(0021)~~ Hybrid wireless locations concepts that combine the above-stated network and handset-based locations concepts exist to reduce the number of ~~BS~~ base station antenna sites and GPS satellites needed to locate a mobile cellular telephone. These hybrid location concepts may utilize augmented GPS (e.g., assisted GPS, differential GPS), or synchronize the GPS satellites and WTLS ~~BS~~ base station sites, offering a faster location process. A similar wireless location concept is ~~disclosed by Jolley, et al.~~ (described in U.S. Pat. No. 6,323,803~~)~~. Hybrid location concepts may exceed FCC wireless E-911 regulatory mandates by increasing location accuracy and reducing location determination time.

~~(0022)~~ Certain basic technical aspects have an essential role in WTLS. Generally, air interface protocols (e.g., TDMA, CDMA, GSM, GPRS, AMPS, ~~AMPS,~~ N-AMPS) and relative frequencies operate in conjunction with a wireless telecommunications transceiver ~~("WTT")~~ (hereinafter referred to as a "wireless transceiver") - an essential component of a mobile cellular telephone - to transmit signals over the WTLS for location determination. All air interface protocols primarily utilize two types of "channels" for wireless signal transmission.

~~(0023)~~ The first type is a control channel, which is typically used for transmitting general identifying information pertaining to the wireless transceiver transmitting the signal. The second type is a voice channel, used primarily for voice communications. Because a voice channel typically does not provide ~~WTT~~ identification information of the wireless transceiver, control channels are often used for wireless location purposes.

~~(0024)~~ In addition, the latest ~~WTT~~ technology allows a ~~mobile cellular telephone~~ wireless transceiver to contain a fully integrated "system on a chip." ~~For example, a WTT may be~~ In one embodiment, the wireless transceiver is of a dual-

band and/or dual-mode configuration (e.g., GSM/GPRS) to optimize voice communications, text messaging (i.e., Short Message Service ("SMS")), and Multi-Media Service ("MMS"), and contain on-chip memory capabilities. ~~Furthermore, the latest~~ Further, Personal Digital Assistants ("PDA's") ~~contain WTT's for mobile cellular telephone functionality~~ include wireless transceivers. PDA's may also integrate wireless local-area network ("W-LAN") modules for wireless data communications with other PDA's or personal computers.

~~(0025)~~ Additional FCC regulations include providing wireless "priority access" service to federal, state, and local public safety and emergency response personnel utilizing mobile cellular telephones. Wireless priority access service provides public safety authorities priority access on wireless telecommunications network systems during widespread emergencies, when the number of calls exceeds the system call capacity. Priority access service could also provide benefits for wireless E-911 location services.

~~(0026) A shortcoming~~ One drawback of the aforementioned wireless location ~~concepts~~ concept is that ~~they are~~ it is primarily designed for determining the geographic location of voice-only mobile cellular telephones. The intended use of wireless E-911 location ~~involves~~ requires the ~~user~~ caller to manually ~~entering~~ enter the "9-1-1" numeric sequence or some variation into the cellular handset keypad~~, thereby contacting a PSAP to report the emergency~~. Once a connection is made, the user must then verbally articulate the nature of the emergency to a 911 ~~dispatcher~~ dispatch center. Although mobile cellular telephones are an important tool for general safety and emergency reporting, they still require a human user to operate, and are not specially designed for fire safety.

~~(0027)~~ Another drawback is that in order to utilize wireless E-911 emergency location services, a user must first purchase or acquire a non-operational mobile cellular telephone, and then enter into a service contract with a wireless telecommunications carrier, which requires an activation fee and monthly

service fee. To help alleviate this problem, the FCC issued an order entitled, "Enhanced 911 Emergency Calling Use of Non-initialized Wireless Phones," which provides for "911 only" mobile cellular telephones to have basic wireless E-911 functionality without ~~having~~ requiring the cellular owner to enter into a service contract with a wireless carrier, ~~and~~ pay an activation fee, and pay monthly service fees. However, these mobile cellular telephones are not specialized for fire safety.

~~(0028) As described above, prior art smoke alarms are primarily used to detect smoke and alert building occupants with an audible or visual alarm, but provide neither a novel means for automatic and direct contact to a PSAP and emergency response resources, nor a novel means for automatic location determination. The prior art also requires that evacuating building occupants or bystanders use voice-only wireline telephones or mobile cellular telephones to contact a PSAP to report a fire emergency.~~

~~(0029)~~ As described above, presently available conventional smoke alarms are primarily used for alerting building occupants with an audible or visual alarm, but do not provide a means to automatically and directly contact a 911 dispatch center. Therefore, in light of the foregoing disadvantages inherent in prior art smoke alarms, a need exists for a new and improved combination smoke detection device that automatically detects fire emergencies, ~~that~~ automatically determines the geographic location of the fire emergency, and automatically ~~dispatches emergency response resources to the~~ contacts an emergency dispatch center to warn of a fire emergency ~~location~~ situation.

SUMMARY OF THE INVENTION

~~(0030) The present invention, the Combination Smoke Alarm and Wireless Location Device,~~ A wireless smoke alarm device provides a ~~novel and innovative device and~~ method to quickly, efficiently, and cost effectively detect the presence of smoke, alert building occupants of ~~the impending~~ a fire emergency,

and transmit emergency identification data signals, which may include ~~via the WTLS (based on the aforementioned network, handset, or hybrid location concepts) to provide the~~ a geographic location of the fire emergency~~, and further dispatching emergency response resources to the fire emergency location~~.

~~(0031) Therefore, the main object of the present device embodiments is a~~ The wireless smoke alarm is an integrated unit ~~which interfaces~~ comprising a ~~WTT~~ wireless transceiver, ~~module with~~ a smoke alarm, and a smoke sensor. ~~such that when the smoke alarm is activated by the presence of smoke,~~ Activation of the smoke sensor triggers the smoke alarm and further activates the wireless transceiver. ~~the WTT module is activated,~~ The wireless transceiver then automatically ~~transmitting stored emergency identification~~ transmits data ~~via the WTLS to a PSAP, thereby summoning emergency responses~~ to an emergency dispatch center. The transmitted data may include the geographic location of the fire emergency.

~~(0032) An inventive feature of the preferred~~ In one embodiment, ~~which provides advantages over other smoke alarms in the prior art, is~~ the ~~WTT module and~~ wireless transceiver includes an integrated memory ~~containing~~ with preprogrammed or predetermined emergency identification data. ~~The WTT module and emergency identification data will allow direct wireless access to a public 911 dispatch center or PSAP. Under current FCC regulations, a carrier is precluded from requiring a prior service or activation contract or charging monthly fees for "911 only" wireless telecommunications devices.~~ The ~~said~~ emergency identification data may be ~~preprogrammed and~~ stored in the ~~WTT module~~ wireless transceiver at either the factory-level, carrier-level, or at the ~~point of sale~~ point-of-sale.

~~(0033) Advantages over prior art smoke alarms include the following:∘ Reduces the risk of physical injury by allowing alerted building occupants safe and expedient evacuation, without having~~ One advantage of the

wireless smoke alarm is that the wireless smoke alarm substantially reduces the concern ~~or confusion~~ of immediately locating a telephone to call 911 ~~to report the~~ during a fire incident. Thus, the building occupants can safely and expeditiously evacuate the building, which reduces the risk of physical injury.

~~o Relays accurate information directly~~ Another advantage is that the wireless smoke alarm transmits data to ~~a PSAP~~ an emergency dispatch center at the time the smoke is detected, ~~reducing~~ which reduces the response time ~~and injury to~~ for the emergency response personnel.

~~o Provides~~ Yet another advantage is that the wireless smoke alarm provides fire protection to building structures that are unoccupied, vacant, undergoing construction, or without ~~wireline~~ wireless telephone service.

~~o Provides~~ In addition, the wireless smoke alarm provides extended protection to residential buildings ~~housing at-risk persons including~~ that house the elderly, handicapped, ~~and~~ hearing impaired, and/or other persons whom may have some difficulty reacting to a fire emergency.

~~(0034) Although this Summary and the Description below contain many specifics, these should not be construed as limitations on the scope of the invention, but rather an exemplification of embodiments thereof. Accordingly, those skilled in the art will appreciate that this novel conception, upon which this disclosure is based, may be utilized as a basis for designing other devices, methods, or systems for carrying out the several purposes of the invention.~~

~~(0035) Further~~ Along with the described embodiments and ~~objects~~ aspects of the ~~invention comprise the following~~ wireless smoke alarm, the wireless smoke alarm can include:~~o Providing~~ a GPS receiver interfaced with the ~~WTT for an augmented or alternate means of~~ wireless transceiver to provide the means for obtaining the geographic location ~~determination~~ of the fire emergency; ~~o Providing~~ a communication link to a wireless local area network ~~transceiver module for allowing wireless interconnection of~~ to connect multiple smoke alarms; ~~o Providing~~

a strobe light for generating a visual alarm; ~~• Providing~~ a radio frequency signal strength meter ~~for measuring WTLS signals~~; ~~• Providing~~ an AC/DC power management transformer system for primary and back-up power; ~~• Providing~~ a disable button~~,~~ for temporarily disabling the alarm ~~activation signal~~; ~~• Providing~~ a time delay control circuit ~~and~~ with a selector switch for temporarily delaying the alarm ~~activation signal;~~, a wireless enhanced 9-11 service; encoding capabilities; and/or any combination of the above.

~~• Providing mobile or fixed mobile communication or computing device means to directly receive processed emergency identification and location data from said WTLS.~~

~~(0036) The Combination Smoke Alarm and Wireless Location Device has all the advantages of prior art smoke alarms, and none of the disadvantages, is easy to use, is easily manufactured and marketed, is of durable and reliable construction, is cost effective, and is economically available to the buying public.~~

Merging the concepts of wireless E-911 location systems, mobile cellular telephones, and smoke alarm devices provides the general public and public safety authorities with an effective tool in the ongoing effort of protecting the public - by saving life and property from the ravages of fire.

In one aspect, a smoke alarm device includes a smoke sensor to sense a threshold of smoke; an alarm control circuit in communication with the smoke sensor, the alarm control circuit configured to generate a signal when the alarm control circuit is activated by the smoke sensor upon the smoke sensing the threshold of smoke; and a wireless transceiver having an integrated memory that includes an enhanced 911 feature with emergency identification data, the transceiver coupled with the alarm control circuit to automatically transmit the emergency identification data to a dispatch center upon receiving the signal from the alarm control circuit, wherein the emergency identification data includes a geographic location of the wireless transceiver.

In another aspect, a method for notifying a dispatch center of an emergency condition includes sensing a predetermined threshold of smoke with a smoke sensor; activating an alarm with an alarm control circuit, the alarm control circuit in communication with the smoke sensor and configured to be activated upon the smoke sensor sensing the threshold of smoke; generating an alarm signal from the alarm control circuit; receiving the signal with a wireless transceiver coupled to the alarm control circuit, the wireless receiver having an integrated memory that includes an enhanced 911 feature; and automatically transmitting an amount of emergency identification data from the wireless transceiver to a dispatch center, wherein the emergency identification data includes a geographic location of the wireless transceiver.

In yet another aspect, a wireless smoke alarm to transmit data to a dispatch center includes an integrated memory having an enhanced 911 service; a sensor configured to generate a signal when an amount of smoke is detected; an alarm control circuit in communication with the sensor and configured to receive the signal from the sensor; and a transmitter in communication with the integrated memory and the alarm control circuit, the transmitter configured to automatically

and contemporaneously transmit at least a geographic location of the wireless smoke alarm of to a dispatch center upon an activation of the alarm control circuit.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, identical reference numbers identify similar elements or acts. The sizes and relative positions of elements in the drawings are not necessarily drawn to scale. For example, the shapes of various elements and angles are not drawn to scale, and some of these elements are arbitrarily enlarged and positioned to improve drawing legibility. Further, the particular shapes of the elements as drawn, are not intended to convey any information regarding the actual shape of the particular elements, and have been solely selected for ease of recognition in the drawings.

FIG. 1 is a block diagram illustrating ~~the components of the Combination Smoke Alarm and Wireless Location Device in the main device~~ a wireless smoke alarm according to one embodiment.

FIG. 2 is a block diagram illustrating the ~~components of the Combination Smoke Alarm and Wireless Location Device in the alternate device embodiments~~ wireless smoke alarm of Figure 1 with added components according to one illustrated embodiment.

FIG. 3 is a flow chart ~~depicting the main~~ showing a method ~~embodiment for automatically determining the geographic location of a smoke alarm and automatically dispatching emergency response resources utilizing WTLS~~ of operation for the wireless smoke alarm according to one illustrated embodiment.

FIG. 4 ~~illustrates an example of a specific application of the preferred device and method embodiments in FIG. 1 and FIG. 3~~ shows a schematic wireless smoke alarm in operation according to one illustrated embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENTS

In the following description, certain specific details are set forth in order to provide a thorough understanding of various embodiments. However, one skilled in the art will understand that the embodiments may be practiced without these details. In other instances, well-known structures associated with smoke alarms and wireless networks have not been shown or described in detail to avoid unnecessarily obscuring descriptions of the embodiments.

Unless the context requires otherwise, throughout the specification and claims which follow, the word "comprise" and variations thereof, such as, "comprises" and "comprising" are to be construed in an open, inclusive sense, that is as "including, but not limited to."

The headings provided herein are for convenience only and do not interpret the scope or meaning of the claimed invention.

~~(0037) The preferred device~~ One embodiment of the ~~Combination Smoke Alarm and Wireless Location Device~~ wireless smoke alarm is shown as a unit 102 in ~~FIG.~~ Figure 1. ~~Thereshown is unit 102, which is preferably confined within a housing that is configured to accommodate and optimize the operational performance of unit 102 components. Unit~~ The unit 102 ~~is preferably~~ can be fixed-mounted to a wall, ceiling, or other surface within ~~the~~ a building structure in ~~where~~ which smoke detection is ~~provided~~ desired.

~~(0038) Power~~ A power supply 104~~, which~~ provides ~~primary~~ power to the unit 102~~, consists of~~ and can be AC power, DC power, or both. ~~Smoke~~ A smoke sensor 106~~, consists of~~ includes a photoelectric ~~or~~ sensor, an ionization ~~sensors~~ sensor, or both. ~~Sensor~~ An alarm control circuit 108 is ~~connected to~~ coupled to and in communication with the smoke sensor 106. ~~, which~~ The alarm control circuit 108 generates an alarm ~~signals~~ signal upon detecting a ~~predetermined~~ threshold of smoke. ~~Connected thereto is~~ An audible alarm horn 110 is coupled to the alarm control circuit 108.

~~(0039) WTT module~~ A wireless transceiver 112 is a cellular processor with an integrated memory~~, similar in structure to WTT's contained in mobile cellular telephones. WTT module 112 provides a integrated memory containing~~ that includes preprogrammed or predetermined emergency identification data. ~~WTT module~~ The wireless transceiver 112 may be configured to transmit the emergency identification data signals via a control channel ~~over a WTLS. WTT module 112~~ and may also be configured with ~~increased~~ an amplifier ~~output for augmented location determination~~.

~~(0040)~~ The ~~preprogrammed or predetermined~~ emergency identification data stored in ~~WTT module~~ the wireless transceiver 112 ~~consists of~~ includes a means for contacting a ~~public~~ 911 dispatch center, which may be alternatively referred to as a ~~or~~ "Public Safety Answering Point" (PSAP). ~~Said emergency identification data configuration may be similar to the preprogrammed data stored in non-service initialized 911-only mobile cellular telephones, but may further include device identification data, and data or coding~~ In addition, the emergency identification data may include parameters describing the nature of the fire emergency. ~~(0041) For example, said stored predetermined emergency identification data may consist of either the FCC's proposed consecutive number code "123-456-7890" with other device-specific data, or the Emergency Services Interconnection Forum proposed Annex C J-STD-036, which is a coded sequence of "911" followed by part of the wireless transceiver's Electronic Serial Number, or International Mobile Station Equipment Identity.~~ The emergency identification data ~~contained in said WTT module 112 memory~~ may be preprogrammed at the factory-level, carrier-level, or at the point of sale into the wireless transceiver 112. ~~WTT module 112 may contain other preprogrammed~~ The emergency identification data ~~for~~ may also include priority access ~~to the WTLS~~ capabilities.

In one embodiment, the emergency identification data may be similar to the preprogrammed data stored in non-service initialized 911-only mobile

cellular telephones, which can include device identification data such as the FCC's proposed consecutive number code "123-456-7890" and/or other device-specific data. In another embodiment, the emergency identification data includes the Emergency Services Interconnection Forum proposed Annex C J-STD-036, which is a coded sequence of "911" followed by part of the wireless transceiver's Electronic Serial Number, and/or an International Mobile Station Equipment Identity.

~~(0042)~~ During ~~normal~~ operation, the unit 102 is powered by the electrical power supply 104~~,~~ and is in a ~~stand-by mode~~ monitoring mode ~~the protected environment for smoke~~. If the smoke sensor 106 ~~senses a predetermined~~ detects the threshold of smoke, the ~~sensor~~ alarm control circuit 108 is set into ~~alarm~~ an activation mode, ~~triggering~~ which triggers the audible alarm horn 110~~, and WTT module 112~~ for as long as ~~smoke threat, is present~~ the threshold of smoke is being detected. ~~Audible~~ The audible alarm horn 110 emits a continuous high-decibel tone to alert building occupants of ~~a~~ an impending fire emergency. ~~, while WTT 112~~ In one embodiment, the wireless transceiver 112 "auto-dials" and transmits the ~~stored~~ emergency identification data ~~signals~~ over ~~the E-911 upgraded WTLS~~ a communications network to a dispatch center ~~PSAP, which dispatches emergency response personnel to the location of unit 102~~. In another embodiment, the wireless transceiver 112 "auto-dials" and transmits the emergency identification data directly to the dispatch center.

~~(0043) An alternate device embodiment of the Combination Smoke Alarm and Wireless Location Device is shown as unit~~ The wireless smoke alarm 202, shown in Figure 2, ~~in FIG. 2. Unit 202~~ is similar to ~~in design to~~ unit 102, but comprises additional features. ~~Unit~~ The unit 202 is contained in ~~preferably confined within~~ a housing, which can be ~~that is configured to accommodate and optimize the operational performance of unit 202 components. Unit 202 is~~

~~preferably~~ fixed-mounted to a wall, ceiling, or other surface ~~within the building structure where smoke detection is provided~~.

~~(0044) Next provided is~~ A power supply 204~~, which~~ provides ~~primary~~ power to the unit 202. ~~Power~~ The power supply 204 may ~~consist of~~ operate with AC power, DC power or ~~a~~ an AC/DC power management and transformer, which provides ~~primary~~ AC power converted to DC power. ~~, and~~ DC power can be stored in a rechargeable DC battery in the event AC power is interrupted. ~~Power~~ A power LED 206 is ~~a means~~ coupled to the housing for visually monitoring ~~the~~ a level of AC or DC power ~~of unit 202~~.

~~(0045) Next provided is~~ A smoke sensor 208~~, consisting of photoelectric or ionization sensors or both. Sensor~~ and an alarm control circuit 210 ~~is connected to smoke sensor 208, which generates alarm signals upon detecting a predetermined threshold of smoke~~ are configured as discussed above.

~~(0046) Also provided and connected to sensor~~ In one embodiment, an alarm disable button 212 coupled with the alarm control circuit 210 ~~is alarm disable button 212, which~~ allows a user to temporarily disable ~~sensor~~ the alarm control circuit 210 for ~~a predetermined~~ an amount of time ~~period~~. ~~Alarm~~ The alarm disable button 212 may include a default mode that renders it inoperable beyond a predetermined number of uses.

~~(0047) Further provided and connected to sensor~~ In yet another embodiment, a time delay control circuit 214 and time delay selector switch 216 are coupled to the alarm control circuit 210 ~~is time delay control circuit 214 and time delay selector switch 216~~. ~~Time~~ The time delay selector switch 216 is a user-set switch allowing multiple predetermined time settings, which when set by a user, sets the time delay control circuit 214, ~~and sets sensor~~ which places the alarm control circuit 210 into a time delay operation mode. ~~Time~~ The time delay operation mode will delay ~~the~~ the transmission of an activation signal generated by ~~sensor~~ the alarm control circuit 210 to ~~other selected device components~~ at least

the wireless transceiver 218. ~~Time~~ The time delay operation mode also provides time for a user to manually press the disable button 212 in the case of a false alarm.

~~(0048) Next provided and~~ A wireless transceiver 218 is interconnected to ~~sensor~~ the alarm control circuit 210 ~~is WTT module 218, which provides~~ and includes a cellular processor with an integrated memory~~, similar in structure to WTT's contained in mobile cellular telephones~~. ~~WTT module 218 provides a~~ The integrated memory ~~containing~~ includes preprogrammed or predetermined emergency identification data. ~~WTT~~ The wireless transceiver module 218 may be configured to transmit the emergency identification data signals via a control channel ~~over a WTLS. WTT module 218 may also~~ and be configured with ~~increased~~ an amplifier ~~output for augmented location determination~~.

~~(0049)~~ The ~~preprogrammed or predetermined emergency identification data stored in WTT module~~ wireless transceiver 218 ~~consists of~~ includes a means for directly transmitting the preprogrammed or predetermined emergency identification data to ~~contacting~~ a ~~public~~ 911 dispatch center ~~or PSAP~~. ~~Said emergency identification data configuration may be similar to the preprogrammed data stored in non-service initialized 911-only mobile cellular telephones, but may further include device identification data, and data or coding describing the nature of the fire emergency.~~

~~(0050) For example, said stored predetermined emergency identification data may consist of either the FCC's proposed consecutive number code "123-456-7890" with other device specific data, or the Emergency Services Interconnection Forum proposed Annex C J-STD-036, which is a coded sequence of "911" followed by part of the wireless transceiver's Electronic Serial Number, or International Mobile Station Equipment Identity. The emergency identification data contained in the WTT module 218 memory may be preprogrammed at the factory~~

~~level, carrier level, or at the point of sale. WTT module 218 may contain other preprogrammed emergency identification data for priority access to the WTLS.~~

~~(0051) Further provided and interconnected to WTT 218 is~~ In one embodiment, the wireless transceiver 218 includes an RF signal strength circuit 220 and an indicator light 222~~,~~ for measuring and monitoring the ~~WTLS~~ strength of the RF signal ~~strength~~. ~~RF signal strength circuit 220 and indicator light 222 allows the user to determine the sufficiency of WTLS signal strength to unit 202.~~

~~(0052) Next provided and interconnected to WTT 218 and sensor alarm control circuit 210 is~~ In another embodiment, a GPS receiver module 224 is in communication with at least one of the wireless transceiver 218, alarm control circuit 210, or both. The GPS receiver module 224 is configured to provide ~~primary or augmented~~ a geographic ~~position determination for~~ location for the unit 202~~, and may be configured for assisted GPS operation~~. In another embodiment, the GPS receiver module 224 may be configured for assisted GPS operation.

~~(0053) Next provided and interconnected to sensor alarm control circuit 210 is~~ In yet another embodiment, an audible alarm horn 226, which may be configured to emit a continuous high decibel tone, is coupled to the alarm control circuit 210. ~~Further interconnected to sensor alarm control circuit 210~~ Additionally or alternatively, a strobe light 228, ~~which may be~~ configured for high candela output, may be coupled to the alarm control circuit 210. ~~Both~~ The audible alarm horn 226 and the strobe light 228 may be ADA compliant for the hearing impaired. During ~~normal~~ operation, ~~sensor~~ the alarm control circuit 210 activates the audible alarm horn 226 and the strobe light 228. During the time-delay operation mode, ~~sensor~~ the alarm control circuit 210 causes the audible alarm horn 226 to emit a intermittent high decibel tone for a duration of ~~the pre-set time delay sequence~~ time.

~~(0054) Next provided and interconnected to sensor alarm control circuit 210 is~~ In yet another embodiment, a wireless local area network ("WLAN")

transceiver 230 and WLAN code selector 232 are in communication with the alarm control circuit 210. The WLAN transceiver 230 is configured to transmit and receive short-range encoded activation signals between multiple ~~Combination Smoke and Wireless Alarm Location Devices~~ wireless transceivers. The WLAN code selector 232 includes a switch with multiple numeric code settings. ~~, which~~ The WLAN code selector allows a user to set a code to limit the WLAN activation signal transmission to ~~only~~ other ~~Combination Smoke Alarm and Wireless Location Devices with~~ wireless transceivers that have the same ~~pre-set~~ numeric code ~~sequence~~ setting.

~~(0055) FIG.~~ Figure 3 is a flowchart ~~depicting the main~~ showing a method ~~embodiment of the present invention. The Combination Smoke Alarm and Wireless Location Device, shown in FIG. 1 as unit 102, is utilized for illustrative purposes only. Other smoke alarm systems either now existing or not may be used in this or similar methods, or be similarly adapted and configured to operate in the method depicted in FIG. 3. The method described below comprises the above-described Combination Smoke Alarm and Wireless Location Device and a WTLS modified with the aforementioned E-911 wireless telecommunication location system architectures~~ for automatically determining ~~the~~ a geographic location of a unit 102, and ~~automatically dispatching emergency response resources. The steps depicted in FIG. 3 should not be limited to the specifics of unit 102, and may incorporate other embodiments. Additionally, the steps described below in FIG. 3 will reference alternate steps comprising further embodiments~~ notifying a dispatch center.

~~(0056) The first step~~ In 302, ~~is to equip~~ a residential or commercial building is equipped with a unit 102 ~~with a Combination Smoke Alarm and Wireless Location Device (unit 102)~~, which monitors the ~~environment where smoke detection is provided~~ building. The ~~residential or commercial~~ building may be under construction, completed, vacant, or occupied. In ~~step~~ 304, the unit 102

senses a ~~predetermined~~ threshold of smoke, which activates ~~said integrated WTT module~~ the alarm control circuit 108 and wireless transceiver 112. ~~In an alternate step, a integrated~~ Optionally, a GPS receiver ~~module~~ may also be activated. If the building is occupied, ~~and if the building~~ occupants ~~are~~ may be alerted by ~~a~~ an audible or visual alarm~~, they will evacuate to safety~~ from the unit 102.

~~(0057) Meanwhile, in step~~ In 306, the ~~WTT module~~ wireless transceiver "auto-dials" and transmits the ~~stored~~ emergency identification data ~~signals to the WTLS~~. If a GPS receiver ~~module~~ is integrated into the ~~device~~ unit 102, the acquired GPS location data ~~would be~~ is also transmitted ~~along with the above mentioned emergency identification data~~. In ~~step~~ 308, the WTLS ~~processes said~~ receives the emergency identification data ~~signals~~, ~~determining~~ which includes the geographic location of the unit 102. In ~~step~~ 310, the ~~WTLS routes said~~ dispatch center receives the emergency identification and location data ~~to a PSAP, who further dispatches emergency response resources to the geographic location of the fire emergency~~. The ~~PSAP~~ dispatch center may dispatch emergency response resources by various ~~wireline or~~ wireless communication means, including but not limited to ~~wireline~~ wireless telephone, the internet, the above-mentioned WTLS, VHF/UHF radio, Enhanced Specialized Mobile Radio, SMS, MMS, or WLAN. ~~In an alternate step,~~ Optionally, the emergency response ~~resources~~ personnel are equipped with mobile wireless communication and computing devices (e.g., Personal Digital Assistants, mobile cellular telephones, or mobile lap-top computers), utilizing the above wireless communication means. ~~,~~ ~~configured to~~ Thus, the emergency response personnel may directly receive ~~from WTLS said processed~~ the emergency identification and location data~~,~~ and then respond to the geographic location of the unit 102.

~~(0058) FIG.~~ Figure 4 ~~illustrates an~~ shows one schematic example of using the ~~combined properties associated with the above referenced FIG. 1 device and FIG. 3 method embodiments and WTLS architectures and patents~~

~~incorporated~~ aforementioned components according to at least one embodiment described herein. ~~Illustrated in FIG. 4 is~~ Figure 4 shows an environment 400~~,~~ ~~containing~~ having a residential building 402~~, which is~~ equipped with ~~Combination Smoke Alarm and Wireless Location Device~~ a wireless smoke alarm 404.

~~(0059)~~ Upon sensing a ~~predetermined~~ threshold of smoke 406 within ~~residential~~ the building 402, ~~Combination Smoke Alarm and Wireless Location Device~~ the wireless smoke alarm 404 transmits ~~predetermined~~ emergency identification data ~~signal 408 by means of WTLS 410~~. In the illustrated embodiment, a WTLS 410 processes and then routes ~~predetermined~~ the emergency identification ~~and location~~ data 412 to ~~PSAP 414, equipped with~~ a dispatch center 414 (*e.g.*, PSAP). The dispatch center 414 includes a GIS display 416~~. GIS display 416 provides~~, which illustratively maps the geographic location of ~~residential~~ the building 402 and wireless smoke alarm 404 ~~Combination Smoke Alarm and Wireless Location Device 404, and dispatches emergency response resources 418 to the geographic location of residential building 402~~.

The various embodiments described above can be combined to provide further embodiments. All of the above U.S. patents, patent applications and publications referred to in this specification are incorporated herein by reference, to include U.S. Patent No. 6,362,743; U.S. Patent No. 5,587,805; U.S. Patent No. 5,019,805; U.S. Patent No. 6,317,604; U.S. Patent No. 6,184,829; U.S. Patent No. 6,353,412; U.S. Patent No. 6,323,803; U.S. Provisional Patent Application No. 60/416,970; and U.S. Provisional Patent Application No. 60/416,971. Aspects of the various embodiments can be modified, if necessary, to employ devices, features, and concepts of the various patents, applications and publications to provide yet further embodiments.

These and other changes can be made in light of the above detailed description. In general, in the following claims, the terms used should not be construed to limit the invention to the specific embodiments disclosed in the

specification and the claims, but should be construed to include all optical scanning and/or optical reading devices that operate in accordance with the claims. Accordingly, the invention is not limited by the disclosure, but instead its scope is to be determined entirely by the following claims.

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